

REMARKS

In view of the foregoing amendments, Applicant respectfully requests favorable consideration and early passage to issue of the present application.

EXPRESS MAIL CERTIFICATE

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October 2, 2001

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Respectfully submitted,

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**APPENDIX A**  
**"Clean" Version of Each Paragraph/Section/Claim**  
**37 C.F.R. § 1.121(b)(ii) and (c)(i)**

CLAIMS:

*subc1* → [Amended] ~~14.~~ A method of manufacturing a semiconductor device according to claim 23, according to claim 24, further comprising:

(d) forming a passivation film on the insulating film of the upper layer, the passivation film exposing the bonding pad.

[Amended] 15. A method of manufacturing a semiconductor device according to claim 14, wherein the passivation film is formed by forming a silicon oxide film and a silicon nitride film.

*B1 rule 37* [Amended] ~~16.~~ A method of manufacturing a semiconductor device according to claim 23, wherein the step (b)(2) of forming the insulating film comprises:

forming a silicon oxide film;

coating hydrogen silsesquioxane resin on the silicon oxide film;

thermally treating the hydrogen silsesquioxane to form a first ceramic silicon

oxide film; and

forming a thick silicon oxide film on the first silicon oxide film by plasma CVD.

*rule 37 B2* [Amended] ~~19.~~ A method of manufacturing a semiconductor device according to claim 23, wherein the step (b)(4) comprises:

forming Ti interlayer insulating films covering an inner surface of the through

holes in the insulating film of the base layer;

forming TiN layers on the Ti interlayer insulating films; and

forming W layers on the TiN layers.

[Amended] 20. A method of manufacturing a semiconductor device according to claim 23, wherein the step (b)(4) comprises:

forming Ti interlayer insulating films covering an inner surface of the through holes in the insulating film of the base layer by sputtering;

*sub C3* →  
forming TiN layers on the Ti interlayer insulating films by sputtering; and  
forming W layers on the TiN layer.

[Amended] 21. A method of manufacturing a semiconductor device according to claim 23,  
wherein the step (b)(4) comprises:

forming Ti interlayer insulating films covering an inner surface of the through  
holes in the insulating film of the base layer;

forming TiN layers on the Ti interlayer insulating films; and

*02 Cont*  
forming W layers on the TiN layer by blanket CVD.

[Amended] 22. A method of manufacturing a semiconductor device according to claim 23,  
wherein the step (b)(1) of forming the conductive pad comprises:

forming a Ti layer;

forming an Al-Cu alloy layer;

forming a Ti layer; and

forming a TiN layer.

*B3* *sub C3* →  
[New] 23. A method of manufacturing a semiconductor device, the method comprising:

(a) forming an insulating film on a semiconductor substrate;

(b) forming a first conductive pad on the insulating film;

(c) forming a first interlayer insulating film on both the first conductive pad and  
the insulating film;

(d) forming a plurality of first through holes in the first interlayer insulating film  
extending from the first conductive pad to an upper surface of the first interlayer insulating film;

(e) filling the plurality of first through holes with conductive material;

(f) forming a second conductive pad on the first interlayer insulating film and in  
contact with the conductive material in the plurality of first through holes;

(g) forming a second interlayer insulating film on both the second conductive pad  
and the first interlayer insulating film;

(h) forming a plurality of second through holes in the second interlayer insulating  
film extending from the second conductive pad to an upper surface of the second interlayer  
insulating film;

(i) filling the plurality of second through holes formed in the second interlayer insulating film with conductive material;

(j) forming a third conductive pad on the second interlayer insulating film and in contact with the conductive material in the second through holes formed in the second interlayer insulating film;

(k) forming a third interlayer insulating film on both the third conductive pad and the second interlayer insulating film;

(l) forming a through hole through the third interlayer insulating film which is substantially the same size as the third conductive pad; and

(m) forming a bonding pad on the third conductive pad in the through hole in the third interlayer insulating film.

[New] 24. A method of manufacturing a semiconductor device, the method comprising:

(a) forming an insulating film on a semiconductor substrate;

(b) forming a base layer over the insulating film by carrying out at least the following acts:

(1) forming a conductive pad on the insulating film;

(2) forming an insulating film on both the conductive pad and the insulating film;

(3) forming a plurality of base through holes in the insulating film of the base layer and extending from the conductive pad to an upper surface of the insulating film of the base layer;

(4) filling the base through holes formed in the insulating film of the base layer with a conductive material;

(c) forming first through nth intermediate layers over the base layer, n being a positive integer greater than 1, the first intermediate layer being formed on the base layer, the remaining intermediate layers being formed one on top of the other, each of the respective intermediate layers being formed by carrying out at least the following acts:

(1) forming a conductive pad on the insulating film of the immediately preceding layer in contact with the conductive material in the through holes of the immediately preceding layer;

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Conc'd

(2) forming an insulating film on both the conductive pad of the respective intermediate layer and the insulating film of the immediately preceding layer;

(3) forming a plurality of through holes in the insulating film of the respective intermediate layer and extending from the conductive pad of the respective intermediate layer to an upper surface of the insulating film of the respective intermediate layer;

(4) filling each of the through holes of the respective intermediate layer with a conductive material; and

(d) forming an upper layer on the nth intermediate layer by carrying out at least the following acts:

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Out

(1) forming a conductive pad on the insulating film of the nth intermediate layer in contact with the conductive material in the plurality of through holes in the insulating film of the nth intermediate layer;

(2) forming an insulating film on both the conductive pad of the upper layer and the insulating film of the nth intermediate layer;

(3) forming an upper through hole through the insulating film of the upper layer, said upper through hole being substantially the same size as the conductive pad of the upper layer; and

(4) forming a bonding pad on the conductive pad of the upper layer, the bonding pad being located in the upper through hole in the insulating film of the upper layer.

[New] 25. A method of manufacturing a semiconductor device according to claim 24, according to claim 24, further comprising:

(e) forming a passivation film on the insulating film of the upper layer, the passivation film exposing the bonding pad.

[New] 26. A method of manufacturing a semiconductor device according to claim 25, wherein the passivation film is formed by forming a silicon oxide film and a silicon nitride film.

*new*  
[New] 27. A method of manufacturing a semiconductor device according to claim 24, wherein the step (b)(2) of forming the insulating film comprises:

forming a silicon oxide film;

coating hydrogen silsesquioxane resin on the silicon oxide film;

thermally treating the hydrogen silsesquioxane to form a first ceramic silicon oxide film; and

forming a thick silicon oxide film on the first silicon oxide film by plasma CVD.

[New] 28. A method of manufacturing a semiconductor device according to claim 24, further comprising a step of planarizing the second silicon oxide film by CMP.

[New] 29. A method of manufacturing a semiconductor device according to claim 24, further comprising a step of planarizing the second silicon oxide film by etching.

*B3*  
[New] 30. A method of manufacturing a semiconductor device according to claim 24, wherein the step (b)(4) comprises:

forming Ti interlayer insulating films covering an inner surface of the through holes in the insulating film of the base layer;

forming TiN layers on the Ti interlayer insulating films; and

forming W layers on the TiN layers.

[New] 31. A method of manufacturing a semiconductor device according to claim 24, wherein the step (b)(4) comprises:

forming Ti interlayer insulating films covering an inner surface of the through holes in the insulating film of the base layer by sputtering;

forming TiN layers on the Ti interlayer insulating films by sputtering; and

forming W layers on the TiN layer.

[New] 32. A method of manufacturing a semiconductor device according to claim 24, wherein the step (b)(4) comprises:

forming Ti interlayer insulating films covering an inner surface of the through holes in the insulating film of the base layer;

*subc  
concl* →  
forming TiN layers on the Ti interlayer insulating films; and  
forming W layers on the TiN layer by blanket CVD.

[New] 33. A method of manufacturing a semiconductor device according to claim 24,  
wherein the step (b)(1) of forming the conductive pad comprises:

*93  
concl*  
forming a Ti layer;

forming an Al-Cu alloy layer;

forming a Ti layer; and

forming a TiN layer.

**APPENDIX B**  
**Version with Markings to Show Changes Made**  
**37 C.F.R. § 1.121(b)(iii) and (c)(ii)**

CLAIMS:

14. A method of manufacturing a semiconductor device according to claim [13] 23, according to claim 24, further comprising [a step of]:

[(h)] (d) forming a passivation film on the [n level interlayer insulating film] insulating film of the upper layer, the passivation film exposing the bonding pad [after said step (j)].

15. A method of manufacturing a semiconductor device according to claim 14, wherein [said step (h) forms] the passivation film is formed by forming a silicon oxide film and a silicon nitride film.

16. A method of manufacturing a semiconductor device according to claim [13] 23, wherein [said step (c)] the step (b)(2) of forming [the first interlayer] the insulating film [comprises the steps of] comprises:

forming a silicon oxide film;  
coating hydrogen silsesquioxane resin on the silicon oxide film;  
thermally treating the hydrogen silsesquioxane to form a first ceramic silicon oxide film; and  
forming a thick silicon oxide film on the first silicon oxide film by plasma CVD.

19. A method of manufacturing a semiconductor device according to claim [14] 23, wherein [said] the step [(f)] (b)(4) comprises [the steps of]:

forming [a] Ti interlayer insulating [film] films covering an inner surface of the [small diameter first] through [hole] holes in the insulating film of the base layer;  
forming [a] TiN [layer] layers on the Ti interlayer insulating [film] films; and  
forming [a] W [layer] layers on the TiN layers.



20. A method of manufacturing a semiconductor device according to claim [13] 23, wherein [said] the step [(f)] (b)(4) comprises [the steps of]:

forming [a] Ti interlayer insulating [film] films covering an inner surface of the [small diameter first] through [hole] holes in the insulating film of the base layer by sputtering;

forming [a] TiN [layer] layers on the Ti interlayer insulating [film] films by sputtering; and

forming [a] W [layer] layers on the TiN layer.

21. A method of manufacturing a semiconductor device according to claim [13] 23, wherein [said] the step [(f)] (b)(4) comprises [the steps of]:

forming [a] Ti interlayer insulating [film] films covering an inner surface of the [small diameter first] through [hole] holes in the insulating film of the base layer;

forming [a] TiN [layer] layers on the Ti interlayer insulating [film] films; and

forming [a] W [layer] layers on the TiN layer by blanket CVD.

22. A method of manufacturing a semiconductor device according to claim [13] 23, wherein [said] the step (b)(1) of forming the conductive pad [layer] comprises [the steps of]:

forming a Ti layer;

forming an Al-Cu alloy layer;

forming a Ti layer; and

forming a TiN layer.